

CLAIMS

1. A tube pump for transferring a fluid, comprising:

a tube defining a flow path therein through which the fluid is transferred, the tube being capable of being deformed elastically, the tube having two opening/closing portions provided at two spaced portions of the tube for opening and closing the flow path; and

two opening/closing mechanisms which are provided so as to correspond to the two opening/closing portions respectively for closing the flow path at the two spaced portions of the tube by folding the corresponding opening/closing portion of the tube and opening the flow path by unfolding the fold of the opening/closing portion;

wherein, when one of the two opening/closing portions is further folded after closing the flow path at the corresponding portion of the tube by operating the corresponding opening/closing mechanism in a state where the other opening/closing portion is folded, an internal pressure in the tube between the two opening/closing portions is increased due to the further fold of the opening/closing portion, and the tube pump transfers the fluid using the increased internal pressure in the tube.

2. The tube pump as claimed in claim 1, wherein the degree of the fold of the tube at the one opening/closing portion is different from that at the other opening/closing portion to generate the increased internal pressure.

3. The tube pump as claimed in claim 2, wherein the tube has two spaced curved portions, and each of the two opening/closing portions is provided at a part of each of the two curved portions; and

wherein the tube pump is constructed so that each of the two opening/closing portions is folded by pushing the part of each of the two curved portions with the corresponding opening/closing mechanism.

4. The tube pump as claimed in claim 3, wherein each of the opening/closing mechanisms includes a cam rotatably provided at a position where the cam faces to the corresponding curved portion, in which each of the two opening/closing portions is folded or unfolded by rotationally driving the corresponding cam so as to push the corresponding curved portion or to release the pushing state by the cam.

5. The tube pump as claimed in claim 4, wherein the degree of fold of the tube at the one opening/closing portion is differentiated from that at the other opening/closing portion by differentiating sizes of the two cams each other.

6. The tube pump as claimed in claim 4, wherein each of the two cams has a substantially semicircular shape.

7. The tube pump as claimed in claim 4, wherein each of the opening/closing mechanisms further includes a protective frame reciprocally provided so as to push the part of the corresponding curved portion or release the pushing state of the part, the protective frame being reciprocally movable by rotationally driving the cam provided inside the frame; and

wherein the tube pump is constructed so that, while each of the two cams is rotatively driven, the corresponding opening/closing portion is folded by pushing the part of the curved portion by movement of the protective frame toward the tube, and the opening/closing portion is restored to an initial state thereof by elastic force of the tube itself when the pushing state by the protective frame is released so as to move the protective frame toward the opposite direction.

8. The tube pump as claimed in claim 7, wherein each of the opening/closing mechanisms further includes a connector for connecting the protective frame to the opening/closing portion.

9. The tube pump as claimed in claim 7, further comprising a base for supporting the tube so that each of the two curved portions

can be deformed elastically, and for supporting the two protective frames so that each of the two protective frames is reciprocally moved in the base.

10. The tube pump as claimed in claim 9, wherein each of the opening/closing mechanisms further includes biasing means arranged between the protective frame and the base for biasing the protective frame in the opposite direction, wherein the protective frame moves in the opposite direction by combination of restoring force of the opening/closing portion and biasing force of the biasing means when the pushing state by the protective frame is released.

11. The tube pump as claimed in claim 9, further comprising a fixing jig for fixing a predetermined portion of the tube to the base;

wherein the tube pump is constructed so that the degree of fold of each opening/closing portion can be controlled by adjusting a mounting position of the fixing jig with respect to the base.

12. The tube pump as claimed in claim 1, further comprising adjusting means for adjusting the degree of fold of each of the two opening/closing portions.

13. The tube pump as claimed in claim 1, wherein the flow path is always closed at any one of the two opening/closing portions.

14. A tube pump for transferring a fluid, comprising:

a tube defining a flow path therein through which the fluid is transferred, the tube being capable of being deformed elastically, the tube having two opening/closing portions provided at two spaced portions of the tube for opening and closing the flow path, and the two opening/closing portions being arranged so as to face to each other through a predetermined space therebetween; and

an opening/closing mechanism provided in the space between

the two opening/closing portions for closing the flow path at the portion corresponding to each of the two opening/closing portions by folding the tube at the opening/closing portion and for opening the flow path by unfolding the fold of the opening/closing portion;

wherein, when one of the two opening/closing portions is further folded after closing the flow path at the corresponding portion of the tube by operating the opening/closing mechanism in a state where the other opening/closing portion is folded, the degree of fold of one opening/closing portion becomes differentiated from that of the other opening/closing portion so that an internal pressure of the tube between the two opening/closing portions is increased due to the further fold of the opening/closing portion, and the tube pump transfers the fluid using the increased internal pressure of the tube.

15. The tube pump as claimed in claim 14, wherein the tube has two spaced curved portions, and each of the two opening/closing portions is provided at a part of each of the two curved portions; and

wherein the tube pump is constructed so that each of the two opening/closing portions is folded by pushing the part of each of the two curved portions with the opening/closing mechanism.

16. The tube pump as claimed in claim 14, wherein the opening/closing mechanism comprises a stepped cam in which two cam portions having different sizes are provided in a stepwise manner so that they are rotatable together, an actuator and two arms, and the cam portions respectively have cam surfaces on outer peripheral surfaces thereof; and

wherein the tube pump is constructed so that the two opening/closing portions are respectively brought into contact with the cam surfaces of the stepped cam via the two arms, so that each of the two opening/closing portions is folded or unfolded by each of the two arms while the stepped cam is rotatively driven.

17. The tube pump as claimed in claim 16, wherein each of the two cam portions of the stepped cam has a substantially

semicircular shape.

18. The tube pump as claimed in claim 14, wherein the opening/closing mechanism further includes biasing means for biasing each of the arms in a direction that the fold of the opening/closing portions is released.

19. The tube pump as claimed in claim 14, further comprising adjusting means for adjusting the degree of fold of each of the two opening/closing portions.

20. The tube pump as claimed in claim 14, wherein the flow path is always closed at any one of the two opening/closing portions.

21. A tube pump for transferring a fluid, comprising:

a tube defining a flow path therein through which the fluid is transferred, the tube being capable of being deformed elastically, the tube having two opening/closing portions provided at two spaced portions of the tube for opening and closing the flow path; and

two opening/closing mechanisms which are respectively provided so as to correspond to the two opening/closing portions, one of the opening/closing mechanisms closing the flow path at one of the two spaced portions of the tube by folding the corresponding opening/closing portion of the tube and opening the flow path by unfolding the fold of the opening/closing portion, and the other opening/closing mechanism closing and opening the flow path at the other portion of the tube without folding and unfolding the corresponding opening/closing portion of the tube;

wherein, when the opening/closing portion is further folded after closing the flow path at the corresponding portion of the tube by operating the corresponding opening/closing mechanism in a state where the other opening/closing portion is closed, an internal pressure in the tube between the two opening/closing portions is increased due to the further fold of the opening/closing portion, and the tube pump transfers the fluid using the increased internal pressure in the tube.

22. The tube pump as claimed in claim 20, wherein the other opening/closing mechanism includes a valve.